

## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.



1.9  
W37 Ha

Reserve

TENTATIVE DRAFT

HANDBOOK

Organization and Operation  
Cooperative Hydrologic Project

U. S. WEATHER BUREAU

in cooperation with

WAR DEPARTMENT  
Corps of Engineers

and

DEPARTMENT OF AGRICULTURE  
Flood Control Coordinating Committee  
Forest Service  
Soil Conservation Service  
Bureau of Agricultural Economics

November 1939

29, 1944.

11B  
00000

## CONTENTS

### FOREWORD

### THE PROJECT PLAN

A. Purposes, General .....	1-2
B. Administration, General .....	2-3
C. Substations, General .....	3-4

### ORGANIZATION AND FUNCTIONS

A. Central Office .....	5-6
B. Regional Center .....	6-11
1. Personnel .....	6
2. Office Administration .....	7
3. General Outline of Procedure in Organizing Region .....	7-9
4. Assembling Data from Recording Gage Stations .....	9
5. Assembling Data from Non-recording Gage Stations .....	9-10
6. Reproduction of Data .....	10
7. Order of Data in Monthly Hydrologic Pamphlet .....	10
8. Dissemination of Data .....	10-11
9. Office Equipment and Supplies .....	11
10. Property Accountability .....	11
C. Regional Suboffices .....	12-13
1. General Comments .....	12
2. Administration .....	12
3. Duties of Field Inspectors .....	12-13
D. Observation Stations .....	13-15
1. Classes of Stations and Factors Observed and Recorded..	13

AUG 1 1944



2. Classes of Observers .....	14
3. Selection of Sites for Substations .....	14
4. Payment to Observers .....	14-15

## INSTRUMENTATION

A. Recording Rain Gage .....	16-22
1. General Specifications .....	16
2. Selection of Site for a Gage .....	16-17
3. Types of Gage Supports .....	17-21
(a) Concrete .....	18
(b) Modified SCS .....	18-19
(c) Wooden .....	19
(d) Wooden, with Platform .....	19-20
(e) Angle Iron .....	20-21
(f) Pipe .....	21
4. Installation and Maintenance of Gage .....	22
B. Non-recording Rain Gage .....	23
1. General Specifications .....	23
2. Selection of Site for a Gage .....	23
3. Mounting Support .....	23
4. Installation and Maintenance of Gage .....	23

## INSTRUCTIONS

A. General Comments .....	24
B. Recording Gage Observer (Class G Station) .....	25-27
1. Equipment and its Use .....	25
2. Duties .....	25
3. Cautions and Precautions .....	25-26





#### 4. Instructions for Charging Recording Precipitation

Gages when Necessary for Winter Use ..... 26-27

#### C. Non-recording Gage Observer (Class H Station) ..... 27-28

1. Equipment and its Use ..... 27

2. Duties ..... 27-28

3. Cautions and Precautions ..... 28

#### TRAVEL

A. Personally-owned Automobile ..... 29

B. Public Conveyance and Government Automotive Equipment ..... 29

#### FORMS

A. General Comments ..... 30-31



## FOREWORD

The remarkable recent development of hydrology as an applied science is reflected in the rapid progress made in flood control planning. Empirical methods are giving way to more rational and scientific procedures which attempt to follow the processes of Nature throughout those phases of the hydrologic cycle involving the transportation of moisture-laden air masses from the sea to inland areas; their concentration and the precipitation of their moisture over relatively small drainage basins; the integration of the resulting run-off into streamflow, and its discharge through the confined dimensions of a channel system.

The Corps of Engineers has made effective use of such modern tools as the unit-hydrograph, storm transposition, and the infiltration theory, and has taken the lead in employing storm morphology for the determination of flood flows.

The Department of Agriculture, charged with that phase of flood control embracing the retardation of run-off, has had to turn to its own researches for solution of many problems on smaller watersheds which comprise the greater sphere of its activities in flood control.

Provision is made for coordination of the work between these Departments. Duplication of effort has been removed or reduced to a minimum and cooperation in the real sense of mutual helpfulness has been established. While the flood control problem of the two departments differs in degree and to some extent in character, there are several aspects which call for closely coordinated action. Among these is the gathering of basic hydrologic data. Both departments have resorted to precipitation for estimates of stream flow determinations at points where there are no discharge records. Both have found existing precipitation data insufficient or inapplicable



to problems involving headwater and tributary areas. Accordingly, a plan of which this handbook is a general outline has been developed to overcome this deficiency by utilizing the functions and facilities of the Weather Bureau. Details of this plan have been developed by combining the recommendations of field offices with respect to station spacing and classification, the results of which have been plotted on maps. These maps, scale 1:1,000,000, show all current and discontinued precipitation stations as well as proposed new station locations.

This handbook is intended as a tentative guide in the operation of the project. It has been prepared by the group which will initiate the work and reflects the collective experience of the Weather Bureau, the Corps of Engineers, the Muskingum micro-climatic project of the Soil Conservation Service, and the cooperative hydrologic project of the Weather Bureau, the Commonwealth of Pennsylvania, and the Geological Survey. The Handbook is necessarily in tentative form and carries no authority to disregard circumstances to be met in the field which are obviously beyond the range of office planning.

Merrill Bernard, Chief,  
River and Flood Division,  
U. S. Weather Bureau.



## THE PROJECT PLAN

### A. Purposes, General.

1. To make available promptly precipitation and related hydrologic data for flood control planning by the Corps of Engineers, and, through the Flood Control Coordinating Committee, the Soil Conservation Service, Forest Service, and Bureau of Agricultural Economics.
2. To organize a nationwide network of precipitation stations to provide data of prescribed quality, insure continuity of record, and establish efficient and economical machinery for dissemination of the data.
3. To provide the means of determining the regimen of rainfall in regions embracing drainage basins for which flood control plans must be made.
4. To overcome the generally recognized deficiency in precipitation data, both as to the number of stations and the quality of data essential to the hydrometeorological analysis of flood-producing storms.
5. To provide basic data of excessive rainfall during short periods over relatively small areas.
6. To make the fullest use of the facilities of the Weather Bureau, comprised of approximately 40 climatological and 70 river district centers, 800 points from which reports are made for use in the airway meteorological service, and 6,000 other observation stations of various types.

# THE HISTORY OF THE

OF THE

OF THE  
OF THE  
OF THE  
OF THE

OF THE

OF THE  
OF THE  
OF THE  
OF THE

OF THE

OF THE  
OF THE  
OF THE  
OF THE

OF THE

OF THE  
OF THE  
OF THE  
OF THE

OF THE

OF THE  
OF THE  
OF THE  
OF THE

OF THE

OF THE  
OF THE  
OF THE  
OF THE

OF THE  
OF THE  
OF THE  
OF THE

OF THE  
OF THE  
OF THE  
OF THE

OF THE



7. To bring into the network the many existing precipitation stations for which the records are not available for general use, because of a lack of an assembling service.
8. To establish regional depositories for precipitation data, primarily to meet the particular needs of the cooperating agencies.
9. To make available in appropriate form the past records of recording precipitation gages operated by agencies other than the Weather Bureau.
10. To standardize instrumentation and observational technique throughout the network.

B. Administration, General.

The service is to be organized as a function of the Weather Bureau under the general administration of the Central Office and the direct supervision of the River and Flood Division. At field offices selected and designated as Regional Centers, general administration will be exercised by the Official in Charge, and direct supervision by the Regional Hydrologic Supervisor.

Close and continuing relations will be maintained between the regional centers and the field offices of the cooperating agencies. No expansion or other significant change in the plan shall be made except through collaboration between the Weather Bureau and the cooperating agencies affected.

Funds allocated to the Weather Bureau from flood control appropriations to carry out the program will be spent and accounted for in field and central office personnel, instruments and equipment, supplies, field transportation, administrative travel, and other expenses essential to the



program. No moneys transferred shall be applied to the routine expenses of the Weather Bureau or be used for any purpose other than that intended under the program.

C. Substations, General.

The demands upon observers appointed under this program considerably exceed those made on the unpaid cooperators who for many years have been the primary source of the Weather Bureau's climatological data. These greater demands include the responsibility for and operation of a fairly complicated recording rain gage, frequent removal and transmittal of autographic charts, close attendance to insure continuity of record, availability for duty at all times and particularly during periods of intense rainfall, and more elaborate and exacting record-keeping than has heretofore been required. It will still, of course, be possible occasionally to engage an observer with sufficient scientific interest to insure proper attendance without pay. But far more often it will be necessary to insure the quality and continuity of the record by paying the observer a nominal amount for his services. The advantageous psychological effect of pay has been amply demonstrated. It provides a basis for business-like supervision of the station, and without it the observer's duty becomes a minor matter among the distractions of everyday living and the record suffers accordingly. If compensation is accepted the responsibility is usually taken seriously and the record fortified against neglect and carelessness. Payment of wages does not, of course, remove the necessity to visit the station, service the equipment, instruct the observer in his duties, stimulate his interest, and point out and correct his mistakes.



In general, substations will be attended by one of the following:

1. A qualified observer available and willing to attend a recording rain gage under the full instruction without pay.
2. A qualified observer, either now established as a cooperative observer or not, available and willing to attend a recording rain gage under the full instruction with pay.
3. An established cooperative observer at a station having acceptable exposure conditions for a non-recording rain gage and willing to accept the additional duties under the full instruction without pay.
4. An established cooperative observer at a station having acceptable exposure conditions for a non-recording rain gage and willing to accept the additional duties under the full instruction with pay.
5. An established cooperative observer at a station having acceptable exposure conditions for a non-recording rain gage and willing to serve under a modified instruction without pay.
6. An established cooperative observer at a station having acceptable exposure conditions for a non-recording rain gage but unwilling or unable to increase his duties, in which case data from the station will be secured from the climatological center.



## ORGANIZATION AND FUNCTIONS

### A. Central Office.

For the purposes of administration and operation of the precipitation station network the United States has been divided into ten (10) hydrologic regions. Sufficient personnel is assigned to the various Divisions in the Central Office to handle expeditiously the various administrative and fiscal matters necessary for the operation of the project. Routine supervision is vested in the River and Flood Division, and all recommendations will be referred to and acted upon by that Division.

Among the functions of the Central Office are:

1. The determination of policies to be followed.
2. General administration over all regions.
3. Coordination of activities within the various regions necessary to uniformity of procedure and efficient operation generally.
4. The purchase of all major items of equipment and supplies, as well as their distribution, to be based as far as may be practicable upon the recommendations from the regional centers.
5. The approval of any service or function which is not usual or customary, but is necessary for carrying on the project.
6. The selection of professional and sub-professional personnel.

Regional officials may recommend the transfer or appointment of qualified persons for these positions, but all further action must be accomplished in the Central Office. Unless such recommendations are made to fill vacancies, appropriate action will be taken without such recommendations.





7. The approval of CAF personnel selected by the Regional Center official. Further comments on these matters are made under "Regional Center".
8. The general collaboration between the Weather Bureau and the co-operating agencies.

B. Regional Center.

1. Personnel.

Personnel at a typical regional center will consist of:

- 1 P-3 Associate Hydrologic Engineer or Meteorologist.
- 1 P-2 Assistant Hydrologic Engineer or Meteorologist.
- 1 P-1 Junior Hydrologic Engineer or Meteorologist.
- 1 CAF-3 Assistant Clerk-Typist.
- 1 CAF-2 Junior Clerk-Stenographer.
- \* 1 CAF-1 Under Clerk-Typist.
- \* 3 CAF-1 Under Clerks.
- # 4 SP-5 Observers (field men).

\* The number of CAF-1 employees in a particular region depends upon the size of the region and the amount of work involved.

# The field men (Observers) will not be assigned to the regional office, but will be under the direct supervision of that office. The number of field men in a region depends upon the size of the region and the number of stations involved. (Further comments are given under "Regional Sub-Office").



2. Office Administration.

Responsibility for the efficient conduct of the program in a region rests with the Supervisor; in his absence, with the subordinate employees designated by him. The Supervisor will outline for and explain to each employee his responsibilities and duties.

3. General Outline of Procedure in Organizing Region.

The general plan for the establishment of new stations during this fiscal year has been formulated in the Central Office, in collaboration with the cooperating agencies. No great deviation from this plan should be made without Central Office approval. The Regional Supervisor will maintain active relations with officials at U. S. Engineer Division and District Offices, Soil Conservation and Forest Service Offices, and Climatological and River District Centers of the Weather Bureau; explain the functions of the program when necessary; make arrangements for the inclusion of existing stations in the network; collaborate in recommending changes in station locations; and obtain information which is of value in the prosecution of the project. Arrangements will be made with proper officials to furnish the regional office with data from stations not under the direct supervision of that office, or to furnish a copy of the original record if the original is not to be retained.

Hourly amounts of precipitation will be tabulated for all stations equipped with recording gages, and 24-hour amounts for stations with non-recording gages. For certain special storms, additional data will be organized, these to include excessive rates for short periods, times of beginning and ending of actual precipitation,



and a breakdown of 24-hour amounts wherever possible for non-recording stations.

One of the principal functions of each regional center will be to improve where necessary the quality of record obtained from all existing stations in the region, as well as to increase the density of non-recording gages and more particularly of recording gages. The Hydrologic Supervisor will maintain a cordial working agreement with the Weather Bureau Section Center officials in his region, and the Field Inspectors of the hydrologic project will inspect and if necessary repair instrumental equipment, or move it to obtain a better exposure, as well as instruct observers at climatological cooperative stations which are included in the hydrologic network. Such work will be done under the direction or with the consent of the proper Section Center officials. Reports of any action affecting either equipment or substation personnel will be made to the proper supervising officials. The same relations will be maintained with River District Center officials, and with supervising officials of all cooperating agencies.

Arrangements will be made whereby daily precipitation amounts from non-recording gages and hourly amounts from recording gages will be furnished the Regional Supervisor for all stations included in the network but for which a copy of the original record cannot be furnished in time for reproduction. All precipitation data collected for a hydrologic region will be tabulated, reproduced, assembled, and distributed to cooperators.



If found practicable, it is planned to make each Regional Center the depository for all precipitation data in the region. Original records and charts from gages operated by the network will be on file at the Regional Center. Copies of autographic records from recording gages operated by other agencies, but included in the network, will be made and kept on file at the Regional Center. If it is impracticable to obtain a copy of the original record for permanent file, it may be photographed on micro-film. In addition, this process seems to be especially ~~suitable~~ for keeping a record of Forms 1009 and 1006, which will be obtained temporarily from Section and River District Center officials. After being photographed, the records will be returned to the proper stations for permanent file.

4. Assembling Data from Recording Gage Stations.

Charts from recording gages will be forwarded from network stations twice weekly. Upon receipt at the Regional Center, the following procedure will be followed:

A supervising official will enter date of receipt on a check list, examine charts carefully and make necessary entries or corrections, initial and forward them to computers and tabulators, who will extract and enter hourly and daily amounts on work sheets. After checking the work, the charts will be filed.

5. Assembling Data from Non-Recording Gage Stations.

Monthly forms from non-recording gage stations in the network will be treated as follows:

A supervising official will enter date of receipt on a check list, examine the forms for errors and make necessary corrections,





initial and forward them to tabulators, who will extract and enter the data on work sheets. The forms will then be filed.

At climatological centers the data from stations under their supervision are usually listed on large work sheets. A carbon copy of these sheets should be obtained by the regional office, and used in the tabulation of data for an entire region.

#### 6. Reproduction of Data.

The multilith process will be used for reproducing the data. This process is rapid, produces material of excellent quality, and meets the needs of the hydrologic program. A sufficient number of copies will be provided to meet the full demands of the cooperating agencies.

#### 7. Order of Data in Monthly Hydrologic Pamphlet.

The data to be reproduced consist primarily of rainfall measurements as made at recording and non-recording stations. Data will appear on both sides of each sheet. The sheets will be assembled in the following order: (1) hourly precipitation data; (2) 24-hour precipitation data. In each case, the states in a region will be placed in alphabetical order, with the stations in each state also in alphabetical order.

#### 8. Dissemination of Data.

Mailing lists will be made up of the offices of the cooperating agencies and others eligible to receive the hydrologic data collected. There will be no public distribution of these data.

Experience will indicate the extent to which data are to be disseminated monthly or made available on call. The present plan



is that hourly data will be assembled from all recording rain gages and daily data from non-recording gages in the network.

9. Office Equipment and Supplies.

Each regional center will be supplied with essential office equipment. The Regional Supervisor will obtain all ordinary and usual equipment in the usual manner (by requisition, or if the office is in a Federal Building, by application to the Custodian or other customary official).

Items listed in General Schedule of Supplies must be purchased if practicable. Station supplies carried in stock in the Supplies Section should be obtained by Stores Requisition and not by purchase in the field, unless otherwise directed.

Special equipment, such as automobiles, multigraph duplicators, standard and special typewriters, adding machines, and Line-a-times (or equivalent) will be furnished, as needed, through Central Office action only. In addition, the purchase of such items as recording and non-recording rain gages, locks, and other special items, will be handled at the Central Office.

10. Property Accountability.

All property used in the hydrologic work of a region will be carried on the property return of the Regional Center. Property may be shipped to any point in the region, but will be invoiced to the Regional Center.



C. Regional Sub-Office.

1. General Comments.

The number of sub-offices in a region will be determined by the size of the region and the number of observation stations to be established and maintained. One Observer (SP-5), acting under the title and in the capacity of Field Inspector, will maintain headquarters at each sub-office. The employee will first report to the Regional Supervisor to become familiar with the work of the regional office, receive training and instructions concerning the program and his work, and be furnished automotive equipment and necessary supplies and tools for field inspection work. He will then proceed to his field headquarters (or regional sub-office).

2. Administration.

For administrative purposes, the Field Inspector will be assigned to the regional sub-office. This Weather Bureau Office will include him on the regular station payroll, provide necessary desk and filing space, etc. The Field Inspector will be entirely subject to the Regional Supervisor as to his duties and his responsibility in completing assignments.

3. Duties of Field Inspectors.

Each Field Inspector will be assigned a definite territory with which he is to become familiar. He is to select the specific gage sites at points which have been recommended by the cooperating agencies and select and instruct the observers. After establishing stations in his territory, periodic trips are to be made to each station. The work will consist then of the establishment of ad-



ditional stations, maintenance of equipment and supervision and instruction of observers. Whenever practicable, the climatological stations which are contributing to the network will also be inspected and maintained under the general direction of the appropriate section center official.

The Field Inspector will be furnished with an adequate supply of ordinary repair parts for the maintenance of instrumental equipment.

D. Observation Stations.

1. Classes of Stations and Factors Observed and Recorded.

High Elevation

Class A - Measuring snow, rain intensity, temperature, humidity, wind direction and velocity, and evaporation.

Class B - Measuring snow, rain intensity, and temperature.

Class C - Measuring snow.

Medium or Low Elevation

Class D - Measuring snow, rain intensity, temperature, humidity, wind direction and velocity, and evaporation.

Class E - Measuring snow and rain intensity.

Class F - Measuring snow and rainfall depth.

Class G - Measuring rain intensity.

Class H - Measuring rainfall depth.

During the fiscal year 1939-40, most of the stations to be established will be Classes G and H.





## 2. Classes of Observers.

Classes of observers are discussed under THE PROJECT PLAN, C. Substations, General, pages 3 and 4.

## 3. Selection of Sites for Substations.

The sites for observation stations should be selected with care, particularly with reference to the conditions of exposure, the availability of a good observer, and any other factors which will insure a continuous and accurate record.

## 4. Payment to Observers.

It will be possible occasionally to obtain the services of a satisfactory observer on a cooperative basis. However, observers will be paid whenever necessary to insure the proper service.

Due to complications which would arise in accounting procedure, an observer who is being paid by the Weather Bureau for any service whatsoever should not be employed as an observer in the hydrologic program, unless the added work is performed entirely on a cooperative basis.

Appointments under this program, whether paid or cooperative, should be covered in the usual manner by Form 4076, with the words "necessary space for proper exposure of instruments" entered in the appropriate Supplemental Agreement. The observer's title will be "Hydrologic Observer". It is necessary that the observer's first name, middle initial, and last name be given on the form. These forms should be forwarded to the Central Office through the appropriate regional centers, together with the form entitled "Establishment of Hydrologic Observation Station". If the substation is not



located in a town, its distance and direction from a town should be given **on this form.**

See Supplement No. 1 to Circular 2, July 1, 1939, for instructions relative to preparation of quarterly Hydrologic Observer payrolls.

The plans of the program are such that payments to observers are not fixed, but such payments should be as consistent as possible. Compensation of observers at Class G and H stations should not exceed \$3.00 per month, except in very unusual cases. Services may be obtained for a smaller monthly amount in many cases. These payments are for following instructions which may be changed in detail from time to time. Under this program, there can be made no extra payments for extra observations or for observations telegraphed or telephoned, and no charges for any of these latter services can be paid from program funds. If any office requires special or telegraphic reports from hydrologic stations, arrangements therefor will be made only under the joint approval of the Central Office and the appropriate Regional Office, and charges for additional compensation or communications made against regular Weather Bureau funds.



## INSTRUMENTATION

It is necessary that instrumentation in all regions be alike in general specifications, and that the same general procedure be followed in setting up new stations. If an existing station is brought into the network, it should be converted into one of the nine standard hydrologic network types whenever possible, and always with the cooperative agency's consent. The majority of installations will be recording and non-recording rain gages, and those types of stations are the only ones considered here.

### A. Recording Rain Gage.

#### 1. General Specifications.

The recording rain gage purchased for the program during this fiscal year (1939-40) is the Reconnaissance Rain and Snow Gage (Friez Catalogue No. 6912); bucket capacity 12"; one revolution of the clock in 24 hours; with dash pot and dust shield; with observation door in case; with dual traverse feature to give a 12" recording capacity on a chart 6 inches high; with case of non-corrosive material. An enameled steel legend will be furnished, lettered "U. S. Weather Bureau, Recording Rain Gage, Do Not Disturb", and attached either to the gage support or to a stake near the gage. The charts, under the effect of moisture, are to expand with time and not with depth.

#### 2. Selection of Site for a Gage.

Factors to be considered in the selection of a site for a gage are:



- a. The site should be near the general location chosen in the network plan.
  - b. The gage should be placed so that its catch will be representative of the locality.
  - c. The exposure must be good. The gage must be at least as far away from an obstruction as the height of the obstruction, and preferably twice as far.
  - d. The gage should be placed on as level ground as can be found. Hill tops or very narrow valleys should be avoided wherever possible.
  - e. The gage should be readily accessible, to insure better attendance and therefore better records.
  - f. The gage site should be such that casual interference will be discouraged or entirely prevented.
  - g. If possible, a site should be chosen so that if the observer's services becomes unsatisfactory or unavailable another observer and site nearby may be used.
  - h. Communication facilities, while not important at this time, should be the deciding factor between two sites of otherwise equal acceptability.
3. Types of Gage Supports.

A support must be designed to hold the gage securely in place and at a predetermined elevation above ground level. It should be neat in appearance, easy to fabricate and set in place, economical, and relatively easy to remove if necessary.

Concrete bases require too much time and equipment to install, except in the few cases where conditions at the stations require





such supports. The selection of the type of support to be used will depend in general upon the preference of the Regional Supervisor, but his choice should be influenced by economy, ease of obtaining and transporting materials, ease of installation, and durability.

Several types of supports are described briefly:

(a) Concrete.

Dig a hole about 10" in diameter and as deep as required. Construct a form of the desired shape and size for the portion of the support which will extend above ground level, and set it firmly in place. Fill hole in ground and form with concrete and use a sufficient amount of reinforcing steel to insure strength and minimize cracking. Before the concrete sets, place three bolts in the top, using the tripod anchor base as a template. After the concrete sets, but before it becomes too hard, remove the anchor base and the form and give a smooth finish to the exposed surface of the support. The anchor base is then replaced and levelled, if necessary, by the use of shims. This type support will be used only when necessary.

(b) Modified SCS.

Three pieces of 4x4" lumber, each about 26" long, previously cut and painted, are fastened together with lag screws so as to form an equilateral triangle of such size that a lag screw passed through each of the three holes in the base of the gage will engage a 4x4" timber near its center. At each angle of the triangle, one 4x4" timber will extend about 6" beyond the angle. To each of these extensions fasten a 2x4" creosoted timber leg of sufficient



length to insure stability when placed in the ground. Dig three holes of sufficient depth to accommodate the legs of the support. Level the support, fill holes and tamp. Use lag screws to hold the gage to the support.

The lumber for this support must be accurately cut in order to fit correctly to form a triangle, and its general use is not recommended. The tripod anchor base supplied with the gages is not needed with this type of support.

(c) Wooden.

The only materials needed are three 3x3" (or 3x4" or 4x4" if preferred) pieces of timber, preferably creosoted, of sufficient length to insure stability for the gage. Dig a hole of desired depth and about 15" in diameter, and place the three legs in such positions that the top of each leg is under one arm of the tripod anchor base. The base is held to the tops of the legs with small lag screws. Level base, fill hole and tamp. Bolt gage to base.

Of the supports described, this one is perhaps the cheapest, simplest, and easiest to install and replace. It can be adapted to meet any condition and no special tools are required.

(d) Wooden, with Platform

Materials needed for the platform are two 1x6x15" and four 1x3x15" pieces of dressed lumber. Three pieces (one 1x6" and two 1x3") are laid flat in the form of a square, with the 1x6" piece in the middle. The other three pieces are placed at right angles on top of the square already formed, and all pieces nailed together. The platform is thus 15" square, about 2" thick, and



has four openings (about 2x2") which permit ventilation and help prevent rotting. Two coats of good aluminum paint should be applied.

Four 3x3" legs, of suitable length and preferably creosoted, support the platform, one leg under each corner. A hole is dug of sufficient size to accommodate the four legs and deep enough to give stability. Level platform and secure it to the tops of legs with lag screws or nails, fill hole and tamp. Attach anchor base to platform with carriage bolts or screws. Bolt gage to base.

The platform can be made and painted at the inspector's headquarters, and the posts or legs purchased as he travels. The support is easy to assemble on the job with few tools, is sturdy, cheap, simple, easy to install, and can meet variable installation conditions.

(e) Angle Iron.

Materials needed for the platform are four 2x6x15" pieces of lumber, painted with two coats of good grade aluminum paint, four  $\frac{1}{2}$ x4" carriage bolts, nails; for the legs, four 1 $\frac{1}{2}$ " galvanized angle irons, pointed at the lower end, with a 9/16" hold punched 2" from upper end, and of sufficient length to insure stability. Two of the angle irons must have the holes punched through one face of the angle, while the other two must have the holes punched through the other face of the angle.

Drive the four angle iron legs into the ground at the corners of a square about 12" on a side, with the top horizontal. Be certain that holes in two adjacent legs face in one direction, and that the holes in the other two legs face in the opposite direction. Drill  $\frac{1}{2}$ " holes in one 2x6" so that it may be bolted in a horizontal



position with the 6" side against the outside face of one pair of legs. Bolt the other 2x6 to the other pair of legs in a similar manner. The top edge of each 2x6 should extend about 1" above the tops of the legs. Place the remaining 2x6" pieces, with the 6" side horizontal, on top of the side pieces and at right angles to them, and nail in place. Attach anchor base to platform and bolt gage to base; or else bolt gage directly to platform.

This support is relatively expensive and would be difficult to construct in the field. The legs cannot be driven into rocky soil. If the wooden portion is kept painted, the support will have a very long life.

(f) Pipe.

Materials needed are three  $3/4$ " pipes of desired length, three  $90^\circ$   $3/4$ " elbows, three pipe caps,  $3/4$ ", cullied and tapped ( $5/16$ " standard thread), one tee,  $3/4$ ", one nipple,  $6\frac{1}{2} \times 3/4$ ", and two nipples  $3 \times 3/4$ ", all items galvanized.

To assemble, screw short nipples into ends of tee, and long nipple into side. Place elbows on ends of nipples, and screw long pipes into elbows. Place caps on ends of vertical pipes. Paint well.

Dig hole large enough to receive the support and deep enough to insure stability. Place support in hole, using a template to hold vertical pipes in position. Fill hole and tamp. Leveling may be accomplished by turning vertical pipes or pipe caps. Bolt gage base directly to top of vertical pipes. The anchor base is not needed.

This support is not too expensive, is relatively simple, and will have a long life. It cannot meet many varying field conditions without the services of a plumber.





#### 4. Installation and Maintenance of Gage.

After installing the support, the gage is fastened to the support and tested. The following steps are suggested:

Remove the collector, outer case, inner case, and any devices used to prevent damage to the gage in shipping. Attach gage to support. Check all screws, nuts, etc., for tightness. Carefully push down the weighing platform as far as possible and release slowly a few times to "work in" the weighing mechanism. Wind clock to be sure it will run. Check the number stamped on the time scale gears. Place chart on clock cylinder and place clock in gage. Check limits of pen travel, and adjust so that the lower limit is below the 0 line and just above cylinder flange, and the upper limit is above the weighing capacity of the gage but not so high that the pen can go off chart. Ink pen and start the flow. Set the pen on zero line with bucket on platform.

Check the gage with calibration weights. If necessary, calibrate the gage. Be certain that the pen reverses (on gage equipped with dual traverse mechanism) exactly on the 6" line.

Check the bucket for leaks.

Carefully instruct the observer regarding all features of the gage and his work.

Whenever the Inspector visits a station he should (1) check every portion of the gage as outlined above; (2) paint any portion of the equipment which needs it; and (3) instruct the observer.



B. Non-Recording Rain Gage.

1. General Specifications.

The standard Weather Bureau non-recording rain and snow gage, 8" in diameter, tube type, with wooden box support, is to be used in the program.

2. Selection of Site for a Gage.

(See comments under INSTRUMENTATION, A, 2).

3. Mounting Support.

The standard 8" non-recording gage box support will be mounted approximately 3" above the ground surface, using four legs of 1" galvanized channel iron driven into the ground deep enough to insure stability. Each piece of channel iron will be screwed to the side of the box support in two places, with top of gage horizontal. This type of mounting is inexpensive and has a comparatively long life.

4. Installation and Maintenance of Gage.

Back out the four screws extending into the octagonal wood piece which is in the upper end of the box support and holds the gage in place for shipment. Remove the gage, place the octagonal cover in the lower position in the support as indicated by screw holes, and fasten it in this position with the screws removed from the top of the support.

Using the support as a guide, drive the channel irons into the ground, as described in "3" above, and screw the channel irons to the support.

Test the rain gage carefully for leaks and repair if necessary.

Carefully instruct the observer regarding the gage and his work.

Whenever the Inspector visits a station, he should check the gage for leaks, and repair or paint any portion of the equipment which needs it. He should check the observer's knowledge of his instructions, supplementing them when necessary.

• • • • •

• • • • •

•

• • • • •

•

## INSTRUCTIONS

### A. General Comments.

The primary object of any precipitation station is to measure as accurately as possible and record the amount of precipitation which falls in the form of rain, snow, hail, or sleet. The observer should understand that his station is an integral part of a nationwide network and that each station is important in making the entire network operate successfully. Each measurement recorded and every note made has an important part in the program. The data entered on forms and remarks made by the observer are the facts upon which those who analyze the records base important decisions. The importance of performing work accurately, consistently, and in detail can hardly be overemphasized.

The characteristics of a good record are:

1. Length. The longer a record is kept, the more valuable it becomes.
2. Continuity. Breaks in a record nullify its value for many purposes.
3. Accuracy. Care and precision in making observations are assumed by those using the data.
4. Completeness. The observer is the only person at a station who is in position to note as they occur all events which are necessary for a proper interpretation of the record.

The suggestions made below for instructions to observers are general and cover only the main features to be emphasized. The Regional Supervisor will furnish each observer with detailed descriptions and explanations of duties in written form.



B. Recording Gage Observer. (Class G Station).

1. Equipment and its Use.

Describe briefly the equipment, including the support, the chart, the clock, the weighing and recording mechanism, the bucket, the receiver, the removable funnel, etc., as well as the routine to be followed in making chart changes, special attention being given to the need for placing on the chart the name of the station and the exact time a change is made, and the information necessary to record on the chart when pen is not filled, the clock not running, etc.

2. Duties.

The duties of the observer are to inspect the gage frequently to determine if it is functioning properly and to empty the bucket during heavy rainfall periods; to change the chart, wind the clock, and empty the bucket twice a week, on days designated by the Regional Supervisor; to note the time of precipitation, depth of snow, the daily chart reading, etc., on a weekly card to be mailed to the Regional Center and to serve as a check on the autographic record; to mail charts promptly after each change to the Regional Center; and to obtain the best possible record within the interpretation of his instructions.

3. Cautions and Precautions.

Prepare a list of "Cautions" so that the observer may be informed as to what not to do as well as what to do. These cautions should emphasize the necessity of emptying the bucket in prolonged heavy rainfall periods and of visiting the gage frequently to see if the clock is running and checks for time. The instruction should





include a warning not to make any adjustments of weighing mechanism, and should inform the observer as to the proper way to dry a clock when it stops in very cold weather. The observer should be told to make reports of any unusual circumstances to the Regional Supervisor.

4. Instructions for Charging Recording Precipitation Gages, when Necessary for Winter Use.

The inside of the catch bucket should be painted with two coats of Quigley's Triple A #10 Black Protective Coating (or equivalent).

Each observer will be furnished a season's supply of flake calcium chloride (in cartons of 1 $\frac{1}{2}$ # each \*) and one quart of Turbo Oil #27 (Shell or equivalent). At approximately the beginning of the snow season, the observer will charge his gage in the following manner: Place in the catch bucket one carton of calcium chloride and one carton of water, stir thoroughly, and pour into the solution two carton capfuls of oil. The catch bucket should then be replaced in the gage but the pen should not be set to zero.

The gage charts will be changed during the winter season at the same times as during summer. The pen, however, should not be set back to zero on the chart at any time, nor should the bucket be emptied until the catch approximates a depth of six inches, at which time the entire contents of the bucket should be emptied and the gage freshly recharged as described above. In regions where very cold weather is experienced, charge the bucket with two cartons of

\* Suggestion: For the calcium chloride, use cylindrical quart-size ice cream cartons, filled to within about one inch of the top.



calcium chloride dissolved in  $1\frac{1}{2}$  cartons of water, and two carton capfuls of oil. Set the pen on the 3" line on chart. Instruct observer to stir in the third carton of calcium chloride when the pen reaches the 6" line on the chart. Empty bucket when 9" of solution are registered on chart.

C. Non-Recording Gage Observer (Class H Station).

1. Equipment and its Use.

Describe briefly the equipment, including the box support, the overflow can, the measuring tube, the receiver, and the measuring stick.

Explain briefly how to measure (1) rainfall, in small and large quantities (over 2"); (2) snowfall. The observer should always indicate depth of snow on ground, depth of new snow in 24 hours, and obtain the water content of new snow by cutting out a section with the 8" can, adding a measured amount of warm water, measuring the resulting water, and subtracting the amount of warm water added.

In northern regions, snow frames may be supplied the observer. The frame consists of a piece of white cotton flannel tacked to a frame made of wood. It is especially valuable in determining the depth of new snowfall which falls in each time period, if there has not been too much wind.

2. Duties.

The duties of the observer are to measure and record the amount of precipitation, together with time of beginning and ending, at a regular time each day. In addition, whenever possible, he will



indicate the time of very heavy rainfall as well as make and record occasional measurements of rainfall at times other than his regular observation hour. These measurements of the amount of rainfall since the last regular observation can easily be made by dropping the measuring stick into the brass tube and recording the time and stick reading on the monthly form under "Remarks". The rain gage will be emptied only once a day - at the regular observation. A weekly card will be forwarded to the Regional Center. At the end of each month, the observer will forward the original and one carbon copy of his record to the Regional Center.

### 3. Cautions and Precautions.

Prepare a list of "Cautions" so that the observer may be informed as to what not to do as well as what to do. This latter will include removal of receiver and tube in freezing weather, during snowfall periods, etc.



## TRAVEL

### A. Personally-Owned Automobile.

The use of personally-owned automobile on a mileage basis (if advantageous and economical) will be authorized only until automotive equipment is secured. A letter of authorization for such use will be issued to each person operating his own automobile.

### B. Public Conveyance and Government Automobile Equipment.

Letters of authorization will be issued to persons having need for travel by public conveyance and/or by Government-owned automotive equipment. It is expected that the Regional Supervisor will travel considerably both by public conveyance and by auto. Field Inspectors will travel principally in trucks, and will only occasionally use public conveyances.

The Regional Supervisor will instruct personnel in his region regarding the procedure to be followed in the use of automotive equipment.





## FORMS

### A. General Comments.

In order to keep to a minimum the confusion which would result from numerous changes in forms, or the adoption of new ones, the general policy outlined below will be followed:

1. Standard Weather Bureau forms will be used whenever possible, and may be obtained on Forms Requisition. New forms will be designed to meet the particular demands of the project. The recommendations and suggestions of the various Supervisors will be considered whenever a form is designed and its use approved by the Central Office.
2. Forms upon which data are placed for distribution must be approved by the Central Office. This restriction does not apply to any temporary form for expediting office routine.
3. All new forms will be prepared in small quantities only in the initial stage of the project.
4. Forms will be restricted to standard sizes. The following are suggested:
  - a. 5x8" cards.
  - b. 3x5" cards.
  - c.  $3\frac{1}{2} \times 7\frac{1}{4}$ " cards for mailing. This is the small franked card on which forecasts are printed.
  - d.  $8 \times 10\frac{1}{2}$ " size for usual paper forms.
  - e.  $8\frac{1}{2} \times 14$ " special forms for reproduction of hourly amounts of precipitation from recording rain gages and 24-hour amounts from non-recording gages.



These forms will be placed on the aluminum stencils at one central location by using a multigraph machine. Each supervisor will requisition the number needed from that central location.

5. Standard forms which may be of use are:

Form No. 1057, Daily Precipitation.

" " 1078-D, Hourly Data - Work Sheet.

" " 1006, River - Rainfall, Monthly Record.

" " 4076, Substation Appointments. This form should be signed by all observers, paid or cooperative.

" " 4076-L, Receipt Card (for instruments).

6. Special forms to be used are:

Station Description Card - 5x8".

Inspection Card -  $3\frac{1}{2} \times 7\frac{1}{4}$ ".

Precipitation for Short Periods.

Observer's Weekly Precipitation Card, recording.

" " " " non-recording.

\*\*\*\*\*

